

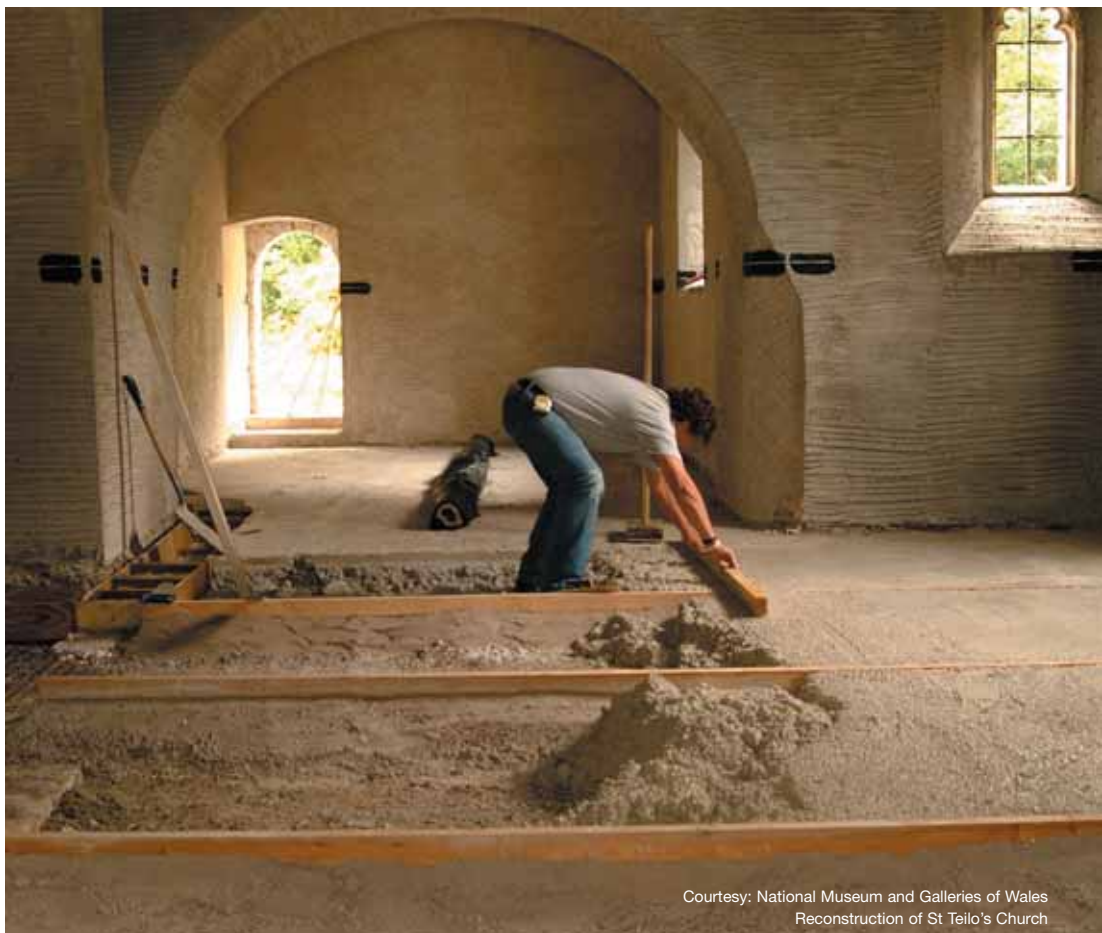


www.lime.org.uk

Tŷ-Mawr

ecological building products
deunyddiau adeiladu ecolegol

insulated limecrete floor



Courtesy: National Museum and Galleries of Wales
Reconstruction of St Teilo's Church

insulated limecrete floor

...breathing life into buildings...

We, at Tŷ-Mawr Lime Ltd, designed this innovative flooring system in 1998 as a **breathable, lightweight alternative to cement-based concrete** for use in old and historic properties. Over the years, we have selected and tested various materials and combinations of materials to both simplify the installation process and improve the 'green' credentials of the floor. It is therefore now being used more and more in ecological new builds.

In 2009, our insulated limecrete flooring system received **LABC (Local Authority Building Control) system type approval**, this means that it is now easier for you to receive Local Authority Building Control approval wherever you are in the UK.

Caring for buildings...Caring for the environment...Caring for health...

Gofalu am adeiladau...Gofalu am yr amgylchedd...Gofalu am iechyd...



insulated limecrete floor ...bre



St John The Baptist Church, Cirencester

history

We know that lime has been used since Roman Times either as mass foundation concretes or as lightweight concretes using a variety of aggregates combined with a wide range of pozzolans (fired materials) that help to achieve **increased strength** and **speed of set**. This meant that lime could be used in a much wider variety of applications than previously such as floors, vaults or domes.

Over the last decade, there has been a renewed interest in using lime for these applications again (after the domination of Portland Cement over the last 50 years or so). At Tŷ-Mawr, we have been involved in researching and developing different systems for lightweight insulated floors. The Tŷ-Mawr insulated limecrete floor comprises of **three layers**:



The Priory Church of St Mary and St Blaise near Chichester.

the limecrete slab

The limecrete slab is a blend of hydraulic lime and pumice - a naturally fired aggregate, that was extensively used by the Romans. The slab is **lightweight, vapour permeable and helps with thermal resistance**. It is this slab layer which is the main **load-bearing element** in the floor, it is here that underfloor heating pipes are fixed.

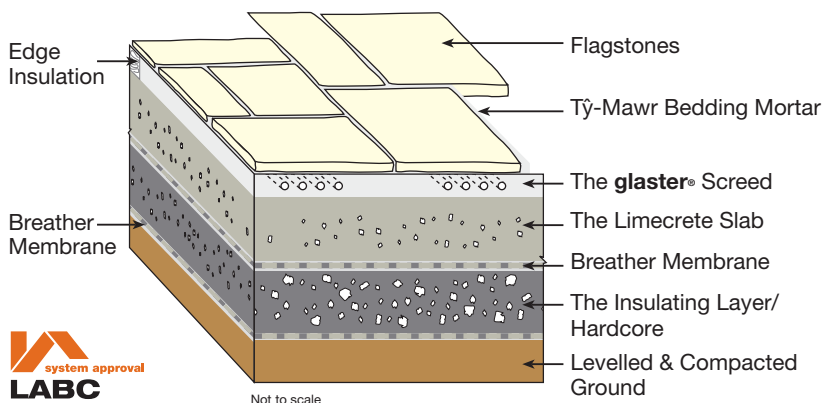
the glaster® screed

This layer is required if bedding thin tiles or if underfloor heating is to be incorporated into the floor, it acts as the thermal store for the heat which is distributed through the pipes.

Again, in trying to improve the 'green' credentials of the floor, our glaster® screed is a blend of recycled glass aggregate and a hydraulic lime binder.

floor finish

The finish should be **vapour permeable** e.g. stone slabs or unsealed quarry tiles are ideal but please note they should be laid and pointed up with a lime mortar (we do a premixed bedding mortar), timber flooring is also possible but should be laid loose on the floor for several weeks with the heating running on low before permanent fixing. An air gap must be maintained between the lime screed and the floor boards. This air gap is necessary to prevent timber from warping. However, it can affect the performance of underfloor heating systems and so needs careful consideration.



the insulating layer

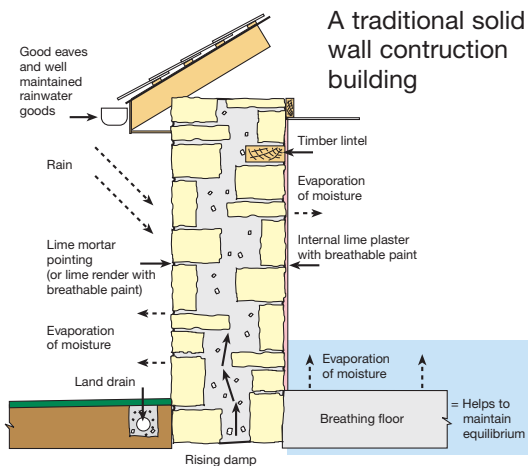
This layer acts as a **moisture break** as well as providing the **insulation** for the floor. We offer two alternative materials for this layer: Hasopor recycled foamglass aggregate or coated LECA (Lightweight Expanded Clay Aggregate). The Hasopor foamglass offers some **environmental advantages** in that it is **recycled** (as opposed to depleting a natural, finite resource) and is **fired at a lower temperature** to LECA. It also has a significantly **lower bulk density** (almost 100%) which offers energy and cost savings in terms of transport. The Hasopor product is also **dimensionally stable** (being angular) which makes it easier for those working with the materials (pouring the slab). Unlike the LECA, it does require a light 'tamping'. LECA is the more economic alternative.



Chapter House floor, Worcester Cathedral

breathing...insulating...approved...

why do I need a 'breathable' floor?



The replacement of **original 'breathing' floors** such as earth, stone slabs and even timber in old buildings with modern impervious damp proof membranes and dense concrete slabs potentially causes **rising damp problems** by creating a build up of water pressure beneath the membrane/slab, the moisture will move sideways until it reaches the existing masonry where it will be able to rise within the wall structure.

This situation is often exacerbated then by use of waterproof cementitious renders and tanking on the walls which **traps the moisture** within the masonry. Replacing 'modern' hard floors with this lightweight, breathable floor can very quickly begin to remedy this type of 'old house' problems.

"The floor's performance has been very promising. Though we have lowered it by a foot, there is no evidence of the serious damp problems that were evident throughout the year around the edges of the previous concrete floor." PR, 2009

These qualities mean that our limecrete flooring system has been chosen by and successfully installed in significant **historic building projects** such as the Chapter House Floor in Worcester Cathedral, The Priory Church of St Mary and St Blaise, Chichester (12th Century), The Viscount Cowdray Estate, Surrey and by the National Museum and Galleries of Wales for the 13th Century Church at St Fagans, but it is just as useful in barns, farmhouses, terraces and cottages.

"...we had to find a method of controlling the relative humidity levels within the building so that both the historic, and new oak, timberwork would not be adversely affected. The use of a

controllable under-floor heating system combined with an insulated limecrete floor... was seen as an ideal way of minimising such problems, enabling the building to dry out gently and naturally, whilst moderating the internal environment for staff and visitors."

EXTRACT FROM HERITAGE MAGAZINE BY DR GERALT NASH, CURATOR, NATIONAL MUSEUM OF WALES, ST FAGANS.

why should it be insulated?

In a response to global warming, governments the world over are setting targets to ensure that **buildings** become much more **energy efficient**.

Part L of the current Building Regulations requires a U-Value (thermal transmittance) of 0.22 W/m²K for a new thermal element (ground bearing floor) and 0.25 W/m²K for a replacement thermal element. Unlike roofs, walls and intermediate floors, U-Value calculations for ground floors cannot be calculated in the normal manner with reference to the construction detail alone. Heat loss from ground floors depends upon the ratio of exposed floor perimeter to total floor area. It is therefore important to consider all elements if your floor is going to give you the best possible performance for your building. **At Tŷ-Mawr, we design the floor build-up for your specific floor to ensure that you comply with the Building Regulations*, all you need to do is complete a simple form available on www.lime.org.uk**

* In certain circumstances Part L Regulations do not apply to listed building works, please discuss this with the Conservation Officer in your Local Planning Authority.

is it approved for use in buildings?

Tŷ-Mawr's insulated limecrete flooring system has an **LABC system-type approval** to show that it can be capable of complying with current Building Regulations **"subject to standard calculations being undertaken and supplied by Tŷ-Mawr for each scheme"**.

Factors that influence the design include:

- > wall thickness and construction type
- > floor area and perimeter length
- > substrate type
- > groundwater pressure
- > radon protection (permeable membranes do not offer radon protection)
- > intended use
- > budget



A heating pipe in the Glasscrete Screed.



Courtesy: Ian Godding and Marches Conservation Services.

St Leonard's Church, Yarpole, Herefordshire



...strong...flexible...easy to use...

strength

In general terms, the maximum strength that it is possible to achieve using a lime based mix is around 16-18 newtons/mm². This exceeds the strengths needed in domestic construction by a considerable margin of safety.

Using the British hydraulic lime, the tests we have commissioned show the following results:

Age (days)	Compressive Strength (N/mm ²)	Density (kg/m ³)
28	4.5	1430
56	6.5	1420
90	8.3	1440

Method of determination of density of hardened concrete, BS1881. Part 144:1983
Method of determination of compressive strength of concrete cubes, BS 1881, Part 116: 1983

Sample	Flexural Strength (N/mm ²)	Density (kg/m ³)
19th Nov Sample 1	0.8	1380
23rd Nov Sample 2	1.1	1410

Method of determination of density of hardened concrete, BS1881. Part 144:1983. Method of determination of flexural strength, BS 1881, Part 118: 1983. Flexural strengths taken at 28 days. A 25% increase in flexural strength can be achieved with the addition of polypropylene fibres.

are contraction/expansion joints necessary?

Our research has shown that the considerations applicable to cementitious concretes with regard to expansion joints are **not applicable** to lime based concretes. Hydraulic Lime generates little heat during the initial chemical hydraulic set and limecrete has a **good flexural strength to compressive strength** ratio. These properties mean that huge savings can be made in terms of the labour and equipment usually required to fabricate dowelled and induced contraction joints in cement concrete ground bearing slabs.

can it be used with underfloor heating?

If under floor heating is to be included in the floor system, then a further layer of material is specified – this is the glaster® screed layer which provides a **thermal store** for the heat distributed through the pipe work.

Heat loss though the floor is controlled by the **insulation layers** beneath (as detailed above). No other insulation material is required beneath the screed but it is advised that you use suitable edge insulation where the screed meets any external un- insulated masonry.

installation

No special skills are required for installing the limecrete flooring system, it is not unlike laying a conventional cement-based concrete floor; a contractor with experience in laying floors should be willing and able to do it.

Excavation, layer depths and full installation instructions are supplied with the flooring components. Tŷ-Mawr is renowned for its **product support**, providing free telephone support and site visits if necessary.

For larger floors, we have a range of **mixers and silos** available for hire to speed up the mixing process and work with with several experienced installation contractors, please contact us for details.

Concrete is the most common construction material used in the world. Cement is the principal ingredient in concrete. Producing one tonne of cement results in the emission of approximately one tonne of CO₂, created by fuel combustion and the calcination of raw materials. Cement manufacturing is a source of greenhouse gas emissions, accounting for approximately 7% to 8% of CO₂ globally. The cement industry has made significant progress in reducing CO₂ emissions through improvements in process and efficiency, but further improvements are limited because CO₂ production is inherent to the basic process of calcinating limestone. Lime is burnt at a lower temperature and has a higher free lime content than cement so that the carbon dioxide reabsorption of lime is greater than that of cement. Importantly, it also allows the floor to be recycled at the end of its useful life! This also helps to address some of the concerns we have about the level of construction waste going to landfill, in the UK this is currently 70-80 million tonnes per year – completely unsustainable!



VBT (Volumetric Batching Truck) Mixer

"Thanks for your help in organising the materials. I'm very satisfied with the results of the floors they were much easier than I thought to lay - and much cheaper than all the quotes I got from other people."

DEL, MILTON KEYNES.



version 3/2010

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For further information on any product or system in this leaflet or to keep up with developments at Tŷ-Mawr, please visit our website www.lime.org.uk and register for regular updates!

Disclaimer - every effort has been made to ensure the accuracy of the information and diagrams in this leaflet, however Tŷ-Mawr can not be held responsible for any direct or indirect loss or damage caused by any inaccuracies. Please call us to check information before ordering.

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